CLAIMS

1. A vaporizer comprising:

a plurality of first cells each having an internal flow passage for a liquid to be vaporized and having opposed ends, a liquid inlet at one of said ends, a vapor outlet at the other of said ends and an internal maze for fluid flow extending between said ends;

a plurality of second cells, each having an internal flow passage defined by spaced walls for a hot fluid and having opposed ends, a hot fluid inlet at one of said ends, and a hot fluid outlet at the other of said ends;

said first and second cells being arranged in a stack in alternating fashion and in heat exchange relation with adjacent ones of said cells and with the ends of the first cells having liquid inlets being closely adjacent the ends of the second cells having hot fluid outlets and with the ends of the first cells having vapor outlets being closely adjacent the ends of the second cells having hot fluid inlets to provide for countercurrent flow of said liquid to be vaporized and said hot fluid within the vaporizer; and

a turbulator in said hot fluid flow passage in each second cell and extending between and bonded to the spaced walls thereof, said turbulator having a length beginning adjacent the ends of the corresponding second cell having said hot fluid outlet and terminating well short of the end having said hot fluid inlet so that said hot fluid passage is characterized by the lack of a turbulator for a distance adjacent said hot fluid inlet.

2. The vaporizer of claim 1 wherein said first cells and said second cell walls are formed by plates.

3. The vaporizer of claim 2 wherein said maze is formed by criss crossing slots or grooves in fluid communication with one another.

4. The vaporizer of claim 3 wherein said criss crossing slots or grooves are located in at least some of the plates of which said first cells are formed.

5. The vaporizer of claim 1 further including spacers between the said second cell walls in said distance adjacent said hot fluid inlet and maintaining the walls of each said second cell in spaced relation.

6. The vaporizer of claim 5 wherein said spacers still allow for the substantial absence of heat transfer enhancements in said distance adjacent said hot fluid inlet.

7. In a vaporizer for vaporizing a liquid fuel for use in a fuel cell system,

at least one first cell having an elongated fuel flow path for fuel to be vaporized and having opposite ends with a liquid fuel inlet at one said end and a gaseous fuel outlet at the other said end;

at least one second hot fluid cell in heat exchange relation with said first cell and having an elongated hot fluid flow path with an inlet end and an opposite outlet end;

said inlet end being adjacent said gaseous fuel outlet and said outlet end being adjacent said liquid fuel inlet so that countercurrent flow will exist between the fuel and the hot fluid;

said fuel flow path being adjacent said hot fluid flow path and divided into a first heating zone for heating liquid fuel and located adjacent said liquid fuel inlet, a second heating zone adjacent said gaseous fuel outlet for superheating vaporized fuel and a third heating zone between said first and second zones in which fuel changes from the liquid phase fuel to the gaseous fuel phase; and

a heat transfer enhancement in said hot fluid flow path in adjacency to said first and third zones;

said vaporizer being characterized by the substantial absence of heat transfer enhancements in that part of said hot fluid flow path adjacent said second zone.

8. The vaporizer of claim 6 wherein said second cell has spaced walls defining said hot fluid flow path and further including spacers extending between said spaced walls to maintain separation between the same and located in said part of said hot fluid flow path adjacent said second zone.

9. The vaporizer of claim 8 wherein said heat transfer enhancements adjacent said first and third zones comprise a turbulator.

10. The vaporizer of claim 9 wherein said turbulator is bonded to said spaced walls.

11. The vaporizer of claim 10 wherein said turbulator is a fin.

12. The vaporizer of claim 11 wherein said fin is a lanced and offset fin.

13. The vaporizer of claim 7 wherein there are a plurality of each of said first and second cells arranged in a stack in alternating fashion, and headers connecting corresponding inlets and outlets of said first and second cells in said stack.

14. The vaporizer of claim 7 wherein said cells abut one another and include a thermally conductive separator sheet at their point of abutment defining a wall common to both said flow paths.

15. The vaporizer of claim 7 wherein there is a first convective resistance R_1 between the hot fluid and a structure between the adjacent fuel flow and hot fluid flow paths, a convective resistance R_3 between said structure and the fuel, a total convective resistance R_T which equals $R_1 + R_3$, a convective resistance ratio $(R_1/R_T)_3$ in the third zone, a convective resistance $(R_1/R_T)_2$ in the second zone, and the difference between the second convective resistance ratio and the third convective resistance ratio is less than 0.25.

16. In a method of vaporizing fuel comprising the steps of:

(a) providing a thermally conductive elongated wall having opposite sides;

(b) flowing a stream of hot fluid along one side of said wall generally in the direction of elongation thereof;

(c) flowing a stream of fuel that is initially in the liquid phase along the other side of the wall in countercurrent relation to said hot fluid stream to cause the liquid fuel to first be heated in a first region along the wall and then to be transformed from the liquid phase to the vapor phase along a second region of the wall and then superheated vapor phase along a third region of the wall, the improvement including the step of

(d) prior to the performance of steps (b) and (c), providing a heat transfer enhancement on said one side of said wall only at locations on said one side opposite said first and second regions, such that there is a substantial absence of transfer enhancements on said one side of said wall at the third region.

17. The method of claim 16 wherein said wall is formed of a metal sheet.

18. The method of claim 17 wherein said heat transfer enhancement is a metallic fin metallurgically bonded to said sheet.

19. The method of claim 18 wherein said fin is a high efficiency fin such as a lanced and offset fin.